

# Royal Dublin Society.

~~~~~  
AFTERNOON SCIENTIFIC LECTURES ON PUBLIC  
HEALTH, 1873.  
~~~~~

## LECTURE V.

ON

## ZYMOTIC AND PREVENTABLE DISEASES,

BY

THOMAS W. GRIMSHAW, Esq., M.D.,

FELLOW AND CENSOR OF THE KING AND QUEEN'S COLLEGE OF PHYSICIANS IN  
IRELAND; PHYSICIAN TO STEVENS' HOSPITAL, AND THE FEVER HOSPITAL,  
CORK-STREET, DUBLIN.



DUBLIN:

PRINTED BY ALEXANDER THOM, 87 & 88, ABBEY-STREET,  
FOR HER MAJESTY'S STATIONERY OFFICE.

1873.

c



## Royal Dublin Society.

---

### ZYMOTIC AND PREVENTABLE DISEASES.

---

THE subject which I have selected for this lecture is a large one—so large that it is scarcely capable of being treated with sufficient depth to make it interesting without being made dull or abstruse from the close condensation of the large number of facts, theories, and suggestions which I shall have to pass in review in the short space of time at my disposal. Fortunately, those who have gone before have cleared the way for me, and I have no doubt that those who will follow in this course of lectures will fill up the many vacancies which I shall have to leave in this discourse. The title of this lecture is “Zymotic and Preventable Diseases”; and I have chosen it with a view of indicating, as closely as a title possibly can, the nature of the subject I have to refer to. I do not propose to discuss all the diseases which might be included among the preventable, or more correctly, the controllable class, but only such as come under the head of “Zymotics,” and therefore more immediately affected by public measures of prevention, and by the conditions which affect large communities. A certain class of diseases, namely, those owing to unhealthy trades are certainly controllable, but will be discussed in the lecture to be delivered by Dr. Mapother. In the first place, I will give you an idea of what I consider to be a preventable disease, and with that view I shall define it as any disease which arises or spreads in consequence of the wilful or careless violation of the laws of nature, which we know it is necessary to observe to insure the preservation of health or prevent the spread of disease. I must also point out the nature of some of these laws of health, and show the result of their violation. Some persons have objected to the term “preventable” being applied to any disease, believing conscientiously that diseases are a direct visitation of God upon his people for his own wise purposes and their benefit. I most heartily concur in this opinion, for if ever direct judgments fall upon mortals for

sins committed, there can be no better examples than those derived from the terrible disasters which have so often followed the wilful or careless violation of the sanitary laws of nature, or, as I prefer to call them, the sanitary laws of God. I say, therefore, with all humility, that the term preventable, as applied to diseases, is in no way impious. Unfortunately, those diseases which are produced by personal and private bad habits are beyond the immediate control of public measures, and are outside the scope of this lecture.

Of these diseases Dr. William Farr remarks :—

“It is here that the various forms of plague are found which experience has shown are influenced to a large extent by sanitary conditions, thus small-pox is diminished by vaccination, enteric fever by sweetness of air, typhus by ventilation, erysipelas (St. Anthony's fire) by cleanliness, metria (puerperal fever) by isolation of mothers, diarrhœa and cholera by the exclusion of sewage from waters in domestic use.”

Now, what do I mean by Zymotic diseases? The term Zymotic has been adopted by those who believe that in these diseases a peculiar pathological process goes on allied to if not identical in nature with fermentation, as observed outside living bodies, this fermentation results in the production of that peculiar train of symptoms characteristic of each one of these diseases. I cannot here enter into the proof or disproof of this theory of Zymosis; but I may state that I believe it to be the true foundation of the pathology of these diseases, and, up to the present, the only one which offers to my mind a reasonable explanation of the phenomena which attend their development, propagation, and results.

I use the word Zymotic only as a term used by the Registrar-General in his returns to signify those diseases commonly known as contagious febrile affections, together with a few other forms, which are not usually accompanied with febrile symptoms, and a few others which may not be, or are but slightly contagious. The chief diseases of this class are Fevers, Diarrhœa, Scarlatina, Small-pox, Whooping-cough, Cholera, Measles, Erysipelas, Metria (or Puerperal Fever), Croup, Diphtheria. There are some others less important, but these are sufficient to show the nature of the class, and their names are, I fear, but too familiar to most of you. We must consider them from several points of view :—

1st. The damage they inflict upon us.

2nd. The conditions under which they spread.

3rd. The conditions under which they arise.

4th. The means suggested for their control.

First,—The amount of danger done to us is immense. Thus from a return ordered by the House of Commons, on the motion of Mr. W. H. Smith, M.P. for Westminster, we find that of the 3,249,077 deaths which occurred in the United Kingdom during the five years 1865 to 1869 inclusive, 712,277, or 21·9 per cent. were caused by Zymotic diseases, in other words, about 1 in every 5 of the deaths is caused by a disease of this kind, and we lose at the rate of about 150,000 people annually in the United Kingdom from Zymotic diseases. The deaths were distributed between the three countries in the following proportions:—

England—111,418, being  $\frac{1}{4}$  of the total mortality, or 1 in 190 of the population.

Scotland—16,193, being  $\frac{1}{4}$  of the total mortality, or 1 in 194 of the population.

Ireland—18,416, being  $\frac{1}{5}$  of the total mortality, or 1 in 308 of the population.

From this we see that Ireland, with all her sanitary defects, is better off than the sister countries in this respect, and I believe this is owing to the energetic efforts of the well organized though badly paid system of Poor Law Medical Service, of which we have had so long to boast of in this country. When to this organization is committed the duty of preventing as well as curing disease, we may expect a still further reduction in the mortality from these diseases.

The deaths in Ireland from the principal Zymotics in the five years thus mentioned were—

Fever, . . .	21,895,	or at the rate of 4,379 per annum.
Scarlatina, . .	16,474	„ „ 3,295 „
Diarrhoea, . .	10,081	„ „ 2,016 „
Whooping-cough,	9,475	„ „ 1,895 „
Small-pox, . .	1,553	„ „ 314 „

From this table it appears that by far the most serious of these Zymotics are such as are always amongst us—1st, Fevers, 2nd, Scarlatina. I shall presently show more fully that the constantly present Zymotics are far more serious than those which only annually visit us, such as Cholera, Small-pox. While these latter quickly sweep away large numbers, thereby striking us with terror, the former gradually and silently eat away thousands without much notice being taken of the effect produced by them. Let us see how these epidemics affect our city of Dublin. The total



number of deaths in Dublin since the Registration Act came into force in 1864, up to the end of last year, 1872, was 73,661, or a weekly average of 157; of these, Zymotic diseases caused 17,156, being 22·6 per cent., and equal to a weekly average of 36·5. These were distributed as follows among the various Zymotics in order of their numbers:—

	Total.	Rate per annum.
Fevers, . . . . .	3,506	389
Diarrhœa, . . . . .	2,576	286
Scarlatina, . . . . .	2,407	267
Small-pox, . . . . .	1,699	188
Whooping-cough, . . . . .	1,464	162
Cholera, . . . . .	1,293	143
Measles, . . . . .	1,124	124

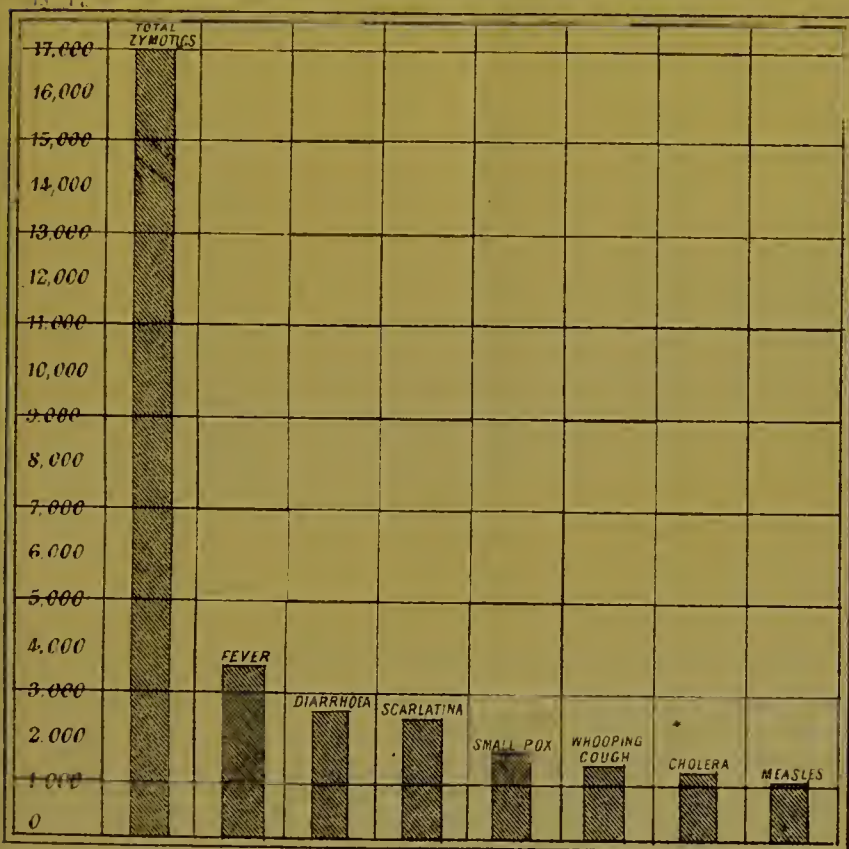
The balance is made up of several others less destructive, but probably not less controllable (see Diagram IV.)

This is farther shown by a comparison of the admissions into the Dublin Fever Hospitals, as seen in Table I. and accompanying diagram. These hospitals take in all kinds of Zymotic diseases, and although a number of other acute diseases not of the Zymotic class gain admission, yet those may be fairly set against the considerable number of Zymotics admitted into the general hospitals, so that Table I. fairly measures the prevalence of Zymotic diseases in Dublin for the 15 years ending March 31st, 1871; but of course only represents a portion of the cases, perhaps a large portion of the worst cases, but scarcely any of the mild ones. The great bulk of the cases here tabulated in Table I. consist of Fever. On inspecting the table, it will be seen that, commencing with the year 1857, when the Board of Superintendence furnished the first Report, the admissions fell until the year 1859, when they rose again for one year (1860), then fell again for one year (1861), to rise again continuously until 1866, when the number of admissions reached 3,562; in this year cholera also prevailed, and that disease is included in the Hardwicke Hospital Returns to the number of 187. Cholera was not admitted into Cork-street Hospital.

Zymotics, especially fever, prevailed to a greater extent in the year 1866 than it has done at any time during the period under consideration; the numbers in Cork-street on one day reached 185, these being nearly all typhus cases. From 1866 (year ending 31st March, 1867) fever steadily decreased until the year 1869, when the admissions reached but 1,823. It has, however, been since rising, the admissions being 2,264 and 2,343 respectively, for the two years ending

## DIAGRAM IV.

Showing the Comparative Mortality from the seven principal Zymotic diseases during 9 years, from 1864 to 1872 inclusive, in the City of Dublin.



2,264 and 2,343 respectively, for the two years ending



March 31st, 1871. It will thus be seen that the rate of admissions to the Fever Hospitals was much the same during the year ending March 31st, 1871, as it was ten years ago.

The total number of admissions were 42,534.

TABLE I.—Showing the ADMISSIONS into the CORK-STREET FEVER HOSPITAL, and the HARDWICKE FEVER HOSPITAL, from the year ending March 31st, 1857, to March 31st, 1871.

Year ending	Admissions into Cork-street Hospital.	Admissions into Hardwicke Hospital.	Total Admissions.
(1)	(2)	(3)	(4)
March 31st, 1857, . . .	1,606	1,705	3,311
" 1858, . . .	1,466	1,626	3,092
" 1859, . . .	1,310	1,609	2,919
" 1860, . . .	1,616	1,430	3,046
" 1861, . . .	1,478	1,174	2,652
" 1862, . . .	1,700	1,129	2,829
" 1863, . . .	1,845	1,179	3,024
" 1864, . . .	1,747	1,405	3,152
" 1865, . . .	2,086	1,249	3,335
" 1866, . . .	2,151	1,411	3,562
" 1867, . . .	1,774	1,379	3,153
" 1868, . . .	1,098	931	2,029
" 1869, . . .	965	858	1,823
" 1870, . . .	1,270	994	2,264
" 1871, . . .	1,357	986	2,343
Total, . . .	23,469	19,065	42,534
Average, . . .	1,564	1,271	2,835

I have shown what a large proportion of the death-rate is caused by Zymotic diseases, namely, one-fourth in England and Scotland, and one-fifth in Ireland, or, more exactly, 21·9 per cent. of the total mortality of the United Kingdom. The chief portion of these deaths is concentrated in the large towns, and is the chief cause of the town death-rate being in excess of the country death-rate. From this we may conclude that the variations in death-rate in large towns will follow very closely the variations in prevalence of Zymotic disease; and the relations in death-rate between different towns will also closely follow the relative prevalence of Zymotic disease. This is well demonstrated in the accompanying tables and diagrams, showing the relation between the variations in death-rate from Zymotics in Dublin, as compared with that of the total death-rate, and the relation between the Zymotic death-rate in large towns, to the total death-rates.

On looking at diagram I. representing, for the past nine years, the relations between total deaths in Dublin, total deaths from Zymotic diseases, deaths from fevers, as a specimen of the result of endemic diseases, and deaths from cholera in 1866, and small-pox in late epidemic as specimens of the results of the only two great epidemics which occurred during this period, it will be evident that, with few exceptions, the variations in the Zymotic deaths correspond very closely with the variations in total deaths. The chief exceptions may be easily explained, and have already been referred to by Dr. Moore; they depend upon the effect of cold, especially intense cold, increasing the deaths from chest diseases to an enormous extent. The best example of this was the intense cold which followed the subsiding of the cholera in 1866, and the cold of the beginning of 1871, specially mentioned by Dr. Moore, for, after the cholera had subsided, the great cold of January, 1867, raised the death-rate higher than it had reached during the height of the cholera epidemic. You see that the curve representing the total deaths is accompanied by one representing the average weekly deaths for the corresponding periods, and we see that, with very few exceptions, where the total death curve rises above the weekly average, that it corresponds with a rise in the Zymotic curve, excepting always the increase owing to great cold, which can easily be corrected by observing the depressions in the curve of weekly mean temperature added to the diagram by Dr. Moore. Again, if we arrange the following large towns according to their death-rate, placing the one with the lowest death-rate at the top of the list, and in a parallel column arrange the same towns according to the death-rate from Zymotic diseases, we shall find a close correspondence:—

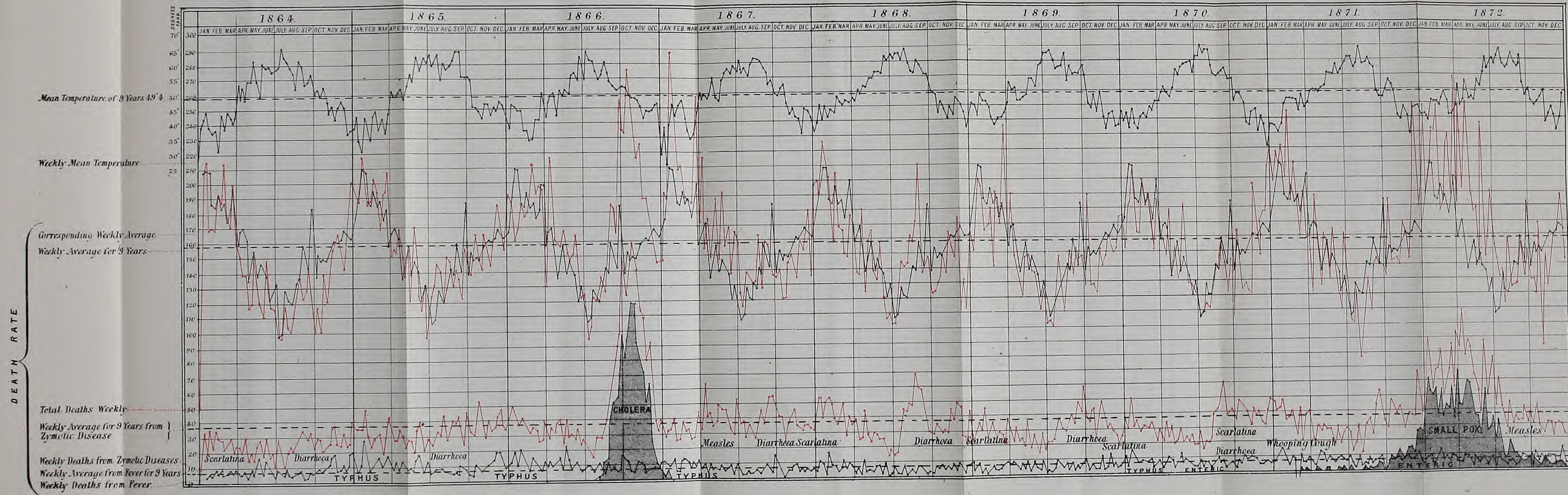
TOTAL DEATH-RATE.	ZYMOTIC DEATH-RATE.
1 Birmingham,	1 Bristol,
2 Hull,	2 Hull,
3 London, Bristol,	3 Birmingham, Leeds,
4 Dublin,	4 Edinburgh,
5 Sheffield,	5 London,
6 Edinburgh,	6 Dublin,
7 Leeds,	7 Sheffield,
8 Newcastle-on-Tyne,	8 Liverpool,
9 Salford,	9 Manchester and Newcastle,
10 Manchester,	10 Glasgow,
11 Liverpool, Glasgow.	11 Salford.

Hull is the only one where this correspondence is exact,



## DIAGRAM I.

Showing the relation between Total Deaths, Total Deaths from Zymotic Diseases, deaths from Fever, Cholera, and Smallpox, weekly for 9 years, ending December 31st, 1872. Compared with the mean temperature for the same period.







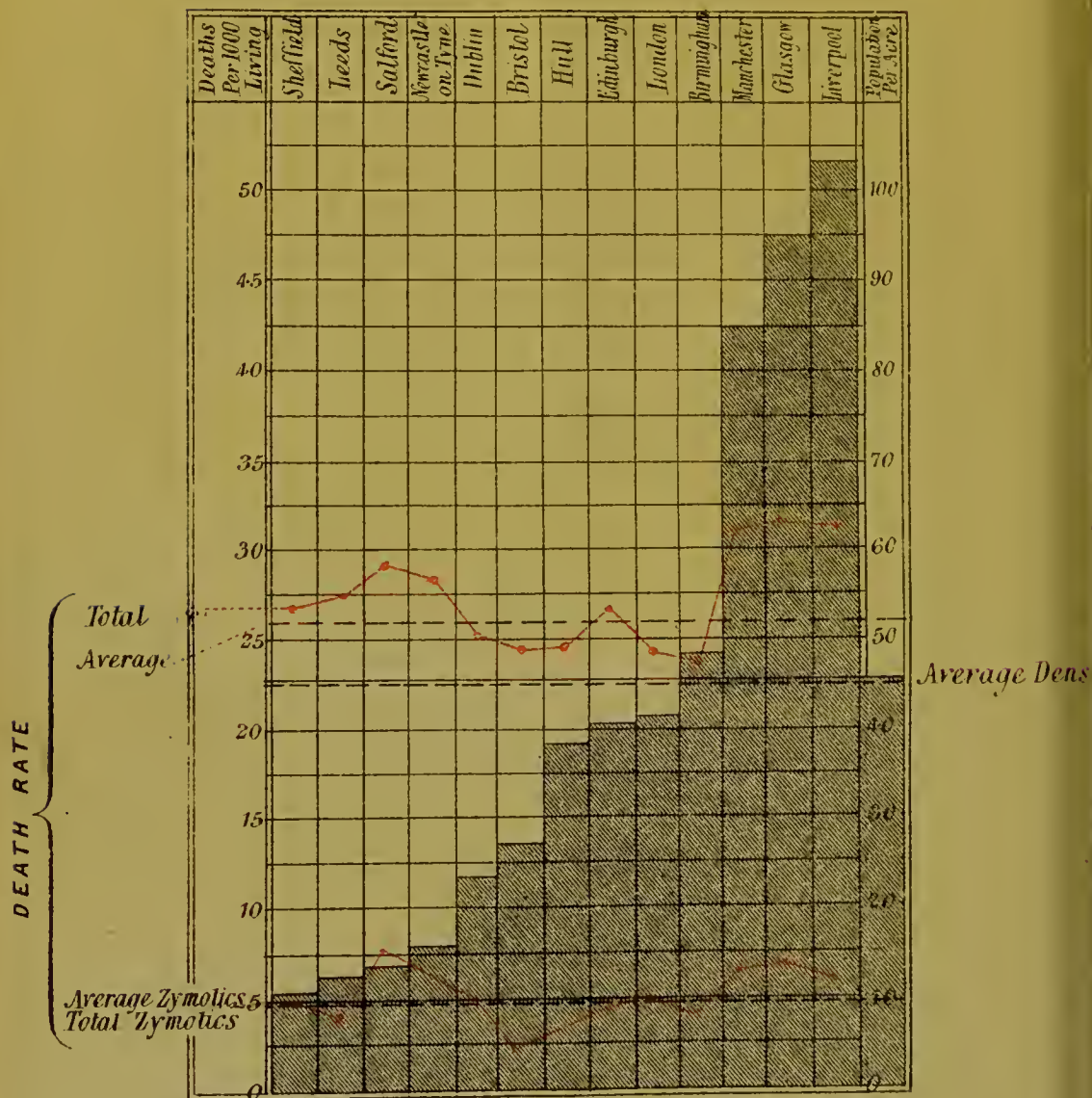




## DIAGRAM II.

Showing the relation between Density of Population,  
Total Death Rate, and Death Rate from 7 Principal  
Zymotics in 13 large towns of the United Kingdom.

*The Shading represents the Density of Population.*



it standing 2nd on both lists. You may also see that although Bristol stands highest as being most free from Zymotics, yet it is 3rd in the death-rate list; Birmingham being first on this list, and 3rd on the Zymotic list. The cases of Birmingham and Bristol I shall refer to again. Dublin, though tolerably high in the death-rate list, is about average so far as Zymotics are concerned.

A reference to table II. and diagram II., constructed to show the relations between total death-rate, Zymotic death-rate, and density of population, in the 13 large towns referred to, will also show a marked amount of parallelism between the curves representing the Zymotic and total death-rates; Bristol being a well marked exception, and this exception is to be altogether attributed to the extensive measures undertaken to improve the sanitary condition of the city, and to maintain the public health.

TABLE II.—SHOWING the relation between density of Population, general Death-rate, and Death-rate from ZYMOTIC DISEASES in 13 large Towns of the United Kingdom, as shown in Diagram II.

Towns.	Population per Acre.	Deaths per 1,000.	Deaths per 1,000 from 7 principal Zymotics.
London, . . .	41·8	24·2	4·5
Bristol, . . .	37·0	24·2	2·0
Birmingham, . . .	48·3	23·4	3·6
Liverpool, . . .	103·0	31·1	5·6
Manchester, . . .	84·5	30·4	6·0
Salford, . . .	23·9	28·5	7·5
Sheffield, . . .	11·2	26·5	4·6
Leeds, . . .	12·3	27·2	3·6
Hull, . . .	38·0	24·1	2·8
Newcastle-on-Tyne, . . .	25·5	28·0	6·0
Edinburgh, . . .	40·6	26·9	4·0
Glasgow, . . .	94·3	31·1	6·4
Dublin, . . .	33·1	25·4	4·4
Total, . . .	45·6	25·8	4·7

In 4 towns the density of population above average.

In 3 of those mortality is above average; in 1 below—Birmingham.

In 3 the Zymotic mortality is above average; in 1 below—Birmingham.

In 9 the density of population is below average.

In 5 of those mortality is above average; in 4 below average.

In 2 of those Zymotic mortality is above average; in 7 below average.

The same proposition that Zymotic death-rate has a nearly constant relation to total death-rate is also shown by a comparison of the 28 districts of the London Registration Division for the year 1870, as shown in table III. and

diagram III., constructed on the same principle as that for the 13 large towns mentioned above.

TABLE III.—SHOWING the Relation between Density of Population, General Death-rate, Death-rate from ZYMOTIC DISEASE, and Pauperism, in the London Registration Districts, as shown in Diagram III.

District.	Population per Acre.	Total average Death-rate per 1,000 for 10 years.	Death-rate per 1,000 from 7 Zymotics, 1871.	Paupers per Population in London District receiving Outdoor Relief, 1871.
Kensington, . . . . .	39.3	19	4.5	1 in 36.9
Chelsea, . . . . .	82.2	25	6.6	" 47.0
St. George's, Hanover-sq., .	74.1	19	4.9	" 30.2
Westminster, . . . . .	235.7	23	4.2	" 40.1
Marylebone, . . . . .	105.4	24	4.2	" 41.0
Hampstead, . . . . .	14.3	17	4.4	" 122.2
Pancras, . . . . .	81.5	22	4.8	" 25.5
Islington, . . . . .	68.0	21	7.2	" 42.2
Hackney, . . . . .	31.7	19	3.8	" 20.7
St. Giles', . . . . .	217.0	28	4.7	" 36.7
Strand, . . . . .	97.2	22	4.2	" 34.5
Holborn, . . . . .	205.2	26	4.1	" 21.9
London City, . . . . .	104.6	19	4.0	" 13.9
Shoreditch, . . . . .	196.8	26	6.1	" 30.4
Bethnal Green, . . . . .	158.2	23	5.0	" 32.4
Whitechapel, . . . . .	185.6	28	4.6	" 22.3
St. George's-in-the-East, .	198.8	29	5.5	" 11.9
Stepney, . . . . .	99.9	27	4.2	" 19.3
Mile End, Old Town, . .	136.8	24	4.7	" 29.0
Poplar, . . . . .	39.4	24	4.5	" 25.6
St. Saviour's, Southwark, .	151.3	29	4.9	" 22.6
St. Olave's, Southwark, .	69.4	29	4.4	" 30.9
Lambeth, . . . . .	51.8	23	5.3	" 32.2
Wandsworth, . . . . .	10.7	20	5.3	" 27.4
Camberwell, . . . . .	25.6	23	3.6	" 30.6
Greenwich, . . . . .	26.6	24	5.2	" 21.7
Lewisham, . . . . .	4.5	18	4.2	" 12.6
Woolwich, . . . . .	9.9	—	6.7	" 44.4
Average, . . . . .	41.8	24.2	4.4	1 in 27.8

From an analysis of the tables from which these curves are constructed, we find that of the 13 large towns enumerated the death-rate is above average in 8, and of these 8 the Zymotic death-rate is above average in 5, nearly at average in 1, below average in 2, and of those where the death-rate is below average, the Zymotic death-rate is never above average, and nearly up to average in but one case only.

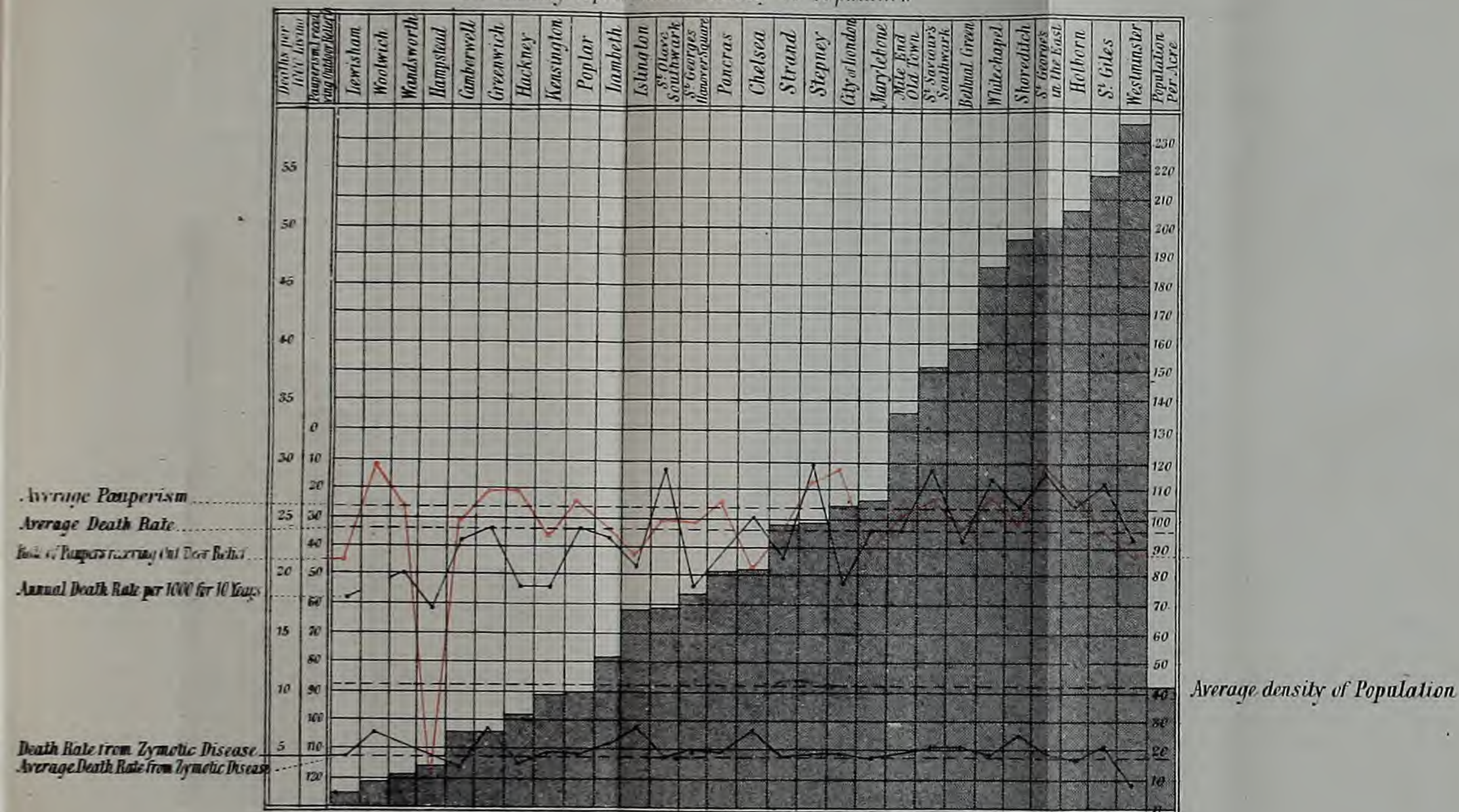
I have thus shown what a large number of lives are lost owing to this class of diseases, and especially owing to those to which I have especially referred; also what an influence Zymotic diseases have on the total death-rate, especially that



## DIAGRAM III.

Showing the relation between Death Rate from all causes, Death Rate from principal Zymotic Diseases, Pauperism and density of Population in the London Registration District.

The Shading represents the Density of Population









of large towns. Besides the absolute loss of life—to this loss of life from preventable disease the term “*life waste*” has been applied by my friend Dr. Maunsell, a high authority on the economic relations of disease and pauperism—the money loss is immense to the community besides to individuals. Thus the small-pox, the most severe epidemic that has visited Dublin this century, except the great fevers of 1826, and famine fever of 1847, and cholera epidemic of 1832 and 1849, cost Dublin not less than £35,000, probably £40,000, for the treatment of the sick. Nearly the whole of this was spent on hospital appliances, food, medicine, and stimulants for the sick, the medical attendance costing a mere trifle, probably not £1,000 for poor law medical relief. Besides this, there was great loss to the trade of the city. The records of the Mansion House Small-pox Relief Committee show the incalculable amount of misery caused by epidemics. These show that the applicants for relief represented 6,000 persons who were affected by small-pox, and who were reduced to apply for relief on account of the loss caused by the disease to them and their friends; 667 heads of families suffered, 179 heads of families died.

None but clergymen and medical men know of the widespread anguish caused by this terrible visitation. The clergy of all denominations were morning, noon, and night passing from house to house, and bed to bed, comforting the sick and dying, the widows and orphans. We members of the medical profession had to visit our hospitals not only once but twice, and often thrice daily; the dispensary medical officers spent their whole time in the dens of this noisome pestilence. As an example of the amount of work thrown upon us by this terrible but preventable disease, there fell to my share within a few of 600 cases, and other members of the profession had to deal with perhaps larger numbers. With such an example as this almost present before our eyes, it is unnecessary to look for other illustrations from more remote or less striking evils; Dr. Stokes has already described to you the terrible results of the famine fever of 1847. After what I have said, and from the important place that small-pox and cholera occupy in diagram I., you will perhaps be surprised to hear that such epidemics are but secondary in their destructiveness; they are more sharp and decisive, but other diseases such as fever, scarlatina, measles, and diarrhoea, do their work of destruction quite as surely, only creating alarm where they rise with epidemics, as indicated in the diagram where their names were introduced between the zymotic and fever cases. Let us compare the relative

amount of damage done by these various zymoties in Dublin during the space of nine years, while there has been a systematic registration of deaths in Ireland. This is shown by diagram IV. and the following table:—

	Total for nine years.	Average rates per annum.
1. Fevers, . . . . .	3,506	389
2. Diarrhœa, . . . . .	2,576	286
3. Scarlatina, . . . . .	2,407	267
4. Smallpox, . . . . .	1,699	188
4. Whooping-cough, . . . . .	1,464	162
6. Cholera, . . . . .	1,293	143
7. Measles, . . . . .	1,124	124

From this you will see that fever is by far the most destructive, and the per-centage of deaths of those attacked being low, the 3,506 deaths represent an enormous number of cases, probably not less than 50,000 severe cases. As fevers are chiefly fatal to adults, while scarlatina, measles, diarrhœa, and whooping-cough are chiefly fatal to children, it is evident that the relative misery and loss produced by fever is greater than any of the other zymoties, and I wish especially to insist on this point that the endemic zymotics constantly among us, any of which may assume the epidemic form, are far more destructive than those which only appear as epidemics, and however much it may be our duty to ward off cholera and small-pox from our shores, yet it is equally our duty, and far more important for our national prosperity and domestic comfort, that we should control these endemic diseases which never die out. The foregoing statements refer not only to Dublin, but to nearly, if not to all, large towns. As I have shown by the diagram how much zymotic death-rate influences the general death-rate, so I can here show how much the fever death-rate influences the zymotic death-rate, and therefore influences the general death-rate more fatally than any single disease, except consumption.

If you look at the curves on diagram I. you will see that the elevations and depressions of the zymotic curve correspond almost invariably with elevations in the fever curve, although zymoties are sometimes high when fever is low, as seen in the diagram, where the various other zymoties which, together with fever, went to make up the total zymotic mortality, are marked between the zymotic and fever lines. There was but one week during the whole nine years represented on diagram I. in which no deaths from fever were registered. There are good reasons why this cor-

respondence should exist, as I shall show when I discuss the conditions under which zymotic diseases spread.

#### CONDITIONS UNDER WHICH ZYMOTIC DISEASES SPREAD.

The conditions which influence the spread of zymotic diseases are numerous, but are easily classified ; they belong to one of two great classes—those belonging to places, or those belonging to persons or population.

##### A. Those belonging to place—

1. Locality, whether high or low, elevation, and geological formation of ground on which it lies.
2. Facilities for drainage and water supply.
3. Age, condition, and construction of streets and houses.
4. Climate.

##### B. Those which belong to population—

5. Density of population.
6. Proportion of pauperism.
7. Cleanliness of inhabitants.
8. Accommodation for the sick.

#### *Locality.*

It is a well established fact that the higher the situation above the level of the sea the less the prevalence of zymotic diseases ; this no doubt is chiefly owing to the facilities afforded by such situations for efficient drainage, and also to the fact that few large communities are so situated. As, however, the situation of all our towns and most of our villages has already been settled, we may almost leave this consideration out of the question. Their position can scarcely be at all effected by public measures, but the defects in situation may be counteracted to a great extent by sanitary measures. As an example of the effects of situation, Birmingham, which from its elevated position, porous soil, and favourable aspect, has a system of natural drainage, although densely populated and without any particularly good sanitary system, is the healthiest of the large towns in the United Kingdom, usually escapes great epidemics, and has a low zymotic death-rate.

#### *Drainage and Water Supply.*

The great effect of proper drainage and water supply on the health of towns is shown by the instances given in the accompanying table IV., taken from the Ninth Report of the



Medical Officer of the Privy Council, from which it appears that a large number of English towns have been materially improved in the health of their population by extensive improvements in drainage and water supply; endemic diseases have permanently diminished, and epidemics have fallen with lightness on these towns since the improvements have taken place. This is especially and almost invariably to be noticed in enteric fever, diarrhoea, and cholera, the only diseases I considered necessary to include in my tables.

This table shows the result in ten of the largest towns enumerated in the report, several others, however, have undergone similar improvements by similar means.

### *Age, Condition, and Construction of Houses.*

It is a notorious fact that old houses in old streets of old towns are the favourite haunts of zymotic disease, and there are other reasons for this besides the age of the houses, for it is here that we find poverty, hunger, and dirt, combined with overcrowding, all of these being promoters of zymotic disease. A comparatively new house may, too, from faults in original construction, want of drainage, and neglect of repairs and cleaning, become as bad as any old house.

I have constructed from the records of the Cork-street Fever Hospital a list of all the houses on the south side of this city, from which cases of fever were admitted into the hospital during a period of two years ending September 30th, 1871. These houses are marked on this map by red dots.\* Two lines intersect the map, and the point of intersection marks the centre of old Dublin as it existed in A.D. 1610; the boundary of the city at this date is also marked on the map, and the boundary of the city in 1728. A glance at the map will show that by far the greater number of fever dots are concentrated in the area of the old city, the remainder being nearly contained between the boundaries of 1610 and 1728, the next oldest part, and but few are situated beyond the latter line or modern part of the city. I have traced out 1,190 of these fever houses; of these there were 122 especially productive of fever, and of these 122 no less than 70 are within the old city boundary. The worst fever streets in Dublin are to be found among the oldest, thus, Francis-street which was fully built in 1610, has 28 infected houses out of 140. The Coombe, though not so old, and Meath-

\* An ordnance map with these and other markings mentioned in the lecture was exhibited at the time of its delivery.

TABLE IV.—ILLUSTRATING the Improvements of PUBLIC HEALTH resulting from Proper Works of Drainage and Water Supply.

Population in 1861.	Name of Town and order of Population.	Periods for which comparisons were made.		Deaths per 10,000 for each period compared.						General Death Rate.		
		Before Works.	After Works.	Enteric Fever.		Diarrhoea.		Cholera in each of Three Epidemics.		Before.	After.	
				Before Works.	After Works.	Before Works.	After Works.	1848-9.	1854.			1866.
160,714	Bristol, . . .	1847-50	1862-5	10	6.5	10.5	9.5	32	11	1.5	245.5	242
68,056	Leicester, . . .	1845-51	1862-4	14.6	7.7	16	19.3	1	10	-	264	252
52,778	Merthyr, . . .	1845-55	1862-5	21.3	8.6	11.5	6.2	267	84	20	332	262
39,693	Cheltenham, . . .	1845-57	1860-5	8	4.7	8.3	7	-	-	-	194	185
32,954	Cardiff, . . .	1847-54	1859-66	17.5	10.5	17.2	4.5	208	66	15.5	332	226
30,229	Croydon, . . .	1845-50	1857-64	15	5.5	10	7	27	21	2	237	190
29,417	Carlisle, . . .	1845-53	1858-64	10	9.7	11.3	12.5	22	6	-	284	261
27,475	Macclesfield, . . .	1845-52	1857-64	14.2	8.5	11.3	11	9	1	-	298	237
24,756	Newport, . . .	1845-49	1860-65	16.3	10.3	11	6.5	112	1.5	12	318	216.5
23,108	Dover, . . .	1843-53	1857-65	14	9	9.5	7	40	10	4.7	225.5	209



street more modern still though old, are remarkably productive of fevers. The same may be said of the old streets lying along the bank of the river, though not on the line of our modern quays. In old times there was no "north side" of Dublin except a small portion around St. Michan's Church and the Abbey of St. Mary, and following the rule I have laid down, these are the worst fever streets on the north side of the city. Now why have I said so much about the localities where fever prevails? because I have ascertained that these also are the places where *all* zymotic diseases arise and spread; thus a cholera map or a small-pox map would be precisely the same as this fever map; the same streets would be in the same colours, and many of the same houses would be marked in both; thus, of 124 fever nests, 58 at least have been also small-pox and cholera nests. This is not true only of Dublin but also other large towns as was shown in the *Lancet* report on "Cholera Haunts and Fever Dens of London," and Dr. Gairdner's remarks on the fever dens of Glasgow point to the same conclusions; but it is unnecessary to go out of our own city to find proof of this. On again referring to the map it will be seen that a number of circles are drawn round certain localities. These represent especially infected places, which are the constant habitats of fever and diarrhœa, and where I have ascertained that cholera and small-pox have prevailed in the last two epidemics—in some instances even in the epidemic dating as far back as the cholera of 1832. I may here describe by extracts from my paper on the "Prevalence and Distribution of Fever in Dublin," and from the report of the Dublin Sanitary Association, the conditions we find in these fever streets and houses:—

"The streets are generally characterized by being composed of old—many of them once fashionable—houses, with bad rears, or no rears at all. It is not essential, as many suppose, that fever streets should be narrow and tortuous; on the contrary, two of the worst fever streets, Meath-street (the very worst), and Francis-street, are wide and straight. It is the age and condition of houses, and proximity of narrow courts and alleys, that especially characterize these streets, together with the want of proper house drainage, ash-pit, and privy accommodation for the houses themselves. As examples of the worst fever streets, I may mention Meath-street, with its 95 houses, 36, or more than a third, of which furnished in all 73 cases of fever to Cork-street Hospital during the two years; it contains one fever-nest furnishing 6 cases, and 10 others furnishing 3 or 4 cases each. Francis-street, with 140 houses, has



MAP SHOWING THE DISTRIBUTION OF FEVER ON THE SOUTH SIDE OF THE CITY OF DUBLIN FOR THE TWO YEARS ENDING SEPTEMBER 30TH, 1871.



Boundary of City of Dublin  
A.D. 1610  
Boundary of City of Dublin  
A.D. 1728

Places where Fever & Diarrhoea constantly  
Prevail and where Cholera & Smallpox  
prevailed in last two Epidemics

Houses furnishing Fever cases during two years ending September 30th, 1871 ■

Fever streets in which the houses could not be accurately defined — — — — —

Boundary of Fever districts - - - - -





28 fever houses, furnishing 55 cases, has in it two fever-nests furnishing more than 5 cases, and 6 houses furnishing 3 or 4 cases each. The Coombe contains 129 houses, has 46 fever houses, furnishing 78 cases, one house furnishing 5 cases, and 4 others furnishing 3 or 4 cases each. These are sufficiently detailed examples of fever streets; but I could mention many others nearly, though not quite so bad. The lanes and alleys are probably worse than the streets, but must be merely looked upon as streets on a smaller scale. The courts (comprising yards and squares) are next to be considered. These are, perhaps, the most prolific fever beds, as few of them have failed to produce fever cases during the past two years. Fever streets are generally skirted by these courts, notably those which I have already given as special examples of fever streets. There are several kinds of courts—first, those originally constructed as such; secondly, lanes closed up at one or both ends, and entered by archways; and thirdly, back yards and gardens that have, by the cupidity of the owners, been built upon, and the out-offices converted into dwelling-houses, thus crowding together a large number of small tenements in a very confined space. These latter are generally known by the name of yards, and are usually designated by the number of the house behind which they are situated. Few people besides clergymen and medical men are acquainted with the existence of these places.

“Examples of the first form of court may be found in abundance off South Great George’s-street and Kevin-street, and a considerable number in the neighbourhood of Townsend-street. They are, in fact, narrow, blind lanes, and have usually an open sewer running down the centre through the whole length, and emptying itself into the adjoining street, or into a trap near the entrance of the court. These traps are frequently choked, and large quantities of sewage accumulate. There is usually a privy, seldom more than one, situated in each of these, as also in the other form of courts; the drainage from this privy, of course, finds its way down the open sewer already described in the centre of the court. The square may be considered as the last of these forms of court, samples of which are Gill’s-square, off Cole-alley, Neil’s-court, off Marrowbone-lane, Derby-square, off Nicholas-street, &c. These squares have usually no drainage, and are surrounded by miserable old overcrowded houses, and are generally strewn with rubbish and filth, consisting, to great extent, of human ordure, and have one or two cess-pools near the centre. I have already indicated the nature of the yards, several of which may be found in Marrowbone-lane, Cork-street, and the Coombe. The houses in all these are of the most filthy character, and the front house or houses in the street usually indicate the nature of what is behind, having the usual characters of a fever-nest, which I shall presently refer to more particularly. The ground of all these courts is saturated with decomposing organic matter, chiefly human excrement.

The following is taken from the Report of the Dublin Sanitary Association :—

October 4th, 1872.

"Nos. 17 and 18, Great Ship-street,—Overcrowding—fever—unfit for habitation in their present state.

"No. 17—*Basement Story* damp and filthy—sewage matter is said, at times, to ooze up through the flagging.

" In the kitchen	<i>front</i>	2 persons live.	
" ground floor	<i>front</i>	7	" " 3 children sick.
" " "	<i>back</i>	4	" " —
" first	<i>front</i>	8	" " 1 person sick.
" " "	<i>back</i>	3	" " 1 person sick.
" second	<i>front</i>	5	" " —
" " "	<i>back</i>	5	" " —
" top	<i>front</i>	5	" " —
" " "	<i>back</i>	1 person lives	" " —

"Total population consists of *forty* persons, *five* of whom are now sick, suffering chiefly from various forms of fever.

"No. 18—*Basement Story* uninhabited, but filthy. The population of the rooms is as follows :—

Ground floor—	<i>front and back</i>	—	4 persons.
First	<i>front</i>	.	6 " "
"	<i>back</i>	.	5 " "
Second	<i>front</i>	.	8 " "
"	<i>back</i>	.	9 " "
Top	<i>front</i>	.	7 " 1 case of fever.
"	<i>back</i>	.	4 " "

"Total population is, therefore, *forty-three* souls. Total population of both houses, *eighty-three* souls, of whom *six* are now ill.

"In the rear of these two houses three cottages are situated.

"No. 1 is inhabited by a family numbering *five* persons, one of whom is ill of fever in Cork-street Hospital, and a second was to-day removed to the Meath Hospital, suffering from phthisis. (She died October 7th, 1872.)

"No. 2 has also *five* inhabitants—two of whom are now in fever—one in hospital, the other, a young child, at home. This, as the other cottages, is divided into two rooms by a wooden partition, not reaching to the ceiling. The total dimensions are 14 by 8½ by 11 feet, the space per head being only 262 cubic feet.

"No. 3 has *seven* inhabitants, two of whom are now suffering from fever in Cork-street Hospital. The father is in extreme danger, having an attack of severe maculated typhus. The rooms in this cottage are very dirty compared with those in Nos. 1 and 2.

"The total population of the holding 17 and 18, Ship-street, is exactly *one hundred* souls.



"The sanitary accommodation consists of a Vartry-water tap, two privies (each with *two* seats), in average order, and one large ashpit, which requires cleansing.

"Your Sub-Committee would call earnest attention to the formidable outbreak of fever which has taken place in these houses—due, in a great measure, to the great overcrowding of the rooms, and to the defective sanitary condition of the basement storey of the houses. No less than 11 per cent. *of the population are at present stricken down by fever.*

"These houses are built on the site of an old graveyard; they face the Ship-street Military Barracks, and a line of stables is situated to the south side of them."—*Report of Dublin Sanitary Association.*

"What are the characters of a fever-nest? The best way to answer this question is by describing one or two. I shall begin with the worst on my list, 58, Bridgefoot-street. This house is entered from the street by a passage, with a black and rotten floor, in which are open chinks communicating with the cellar below; the boards are damp and sodden with dirt. Going upwards, we find things somewhat better, but the whole upper part of the house is dilapidated. Going downwards, we first come to the entrance of a small back yard, a place covered ankle-deep with human filth, a privy and ashpit totally unapproachable without passing through a sea of dirt, a water-tap running, and washing such of the dirt as is within reach into a pipe sewer which runs through the cellar of the house, and which has a hole through which the sewage passes into the cellar, converting it into a cesspool; this cellar is immediately beneath two rooms inhabited by a family of fifteen, every one of whom has had enteric fever. In the same street I find another house with all these characteristics repeated, except the broken sewer, but this house had no sewer at all. A house in Chancery-lane furnished eight cases of fever (seven typhus and one enteric). I was met on entry by a horrible stench, proceeding partly from a filthy back yard, and partly from a slaughter-house at the rear of a neighbouring house in Bride-street. The cellar of this house had been filled up—a very proper measure, if rightly carried out; but the filling-up matters consisted of such material as to convert the cellar into a decomposing manure heap. The passage, back yard, and upper part of the house were similar to those already described at 58, Bridgefoot-street. I find similar conditions, varying only in degree, in almost every fever-nest. The less prolific fever-nests I find with less accumulated dirt, and notably less wet dirt. In many places where there was comparatively little dirt, what did exist was made to do the maximum amount of damage by being kept in a continual state of moisture, for want of proper drainage, or from drainage water from the roof or elsewhere running into the house by the doors, or through imperfectly closed cellar openings. These damp cellars, often nearly

filled with rubbish, are to be found in all fever streets and most fever houses. Many houses have no receptacle for rubbish except the cellars; this is particularly true of corner-houses and houses near corners, many of which, if not public-houses, are fever-nests. Of the condition of these houses I may also state that a large number are condemned houses—that is, houses declared by the authorities as unfit for human habitation; but, through some evasion, or, in many cases, in open violation of the law, these houses are still inhabited, and frequently the occupiers even pay rent. I find that among my list of fever houses, there are fifty-two returned as bankrupt in the last report of the Collector-General of Rates; thus, the owners of these (who defy the tax-gatherer) and of the condemned houses, go free of the burdens of ordinary citizens, and claim as their privilege to spread disease and death at the expense of their honest, and, perhaps, not more prosperous neighbours.”—*Prevalence and Distribution of Fever in Dublin.*

We next come to the conditions affecting the population themselves, as promoting causes of Zymotic diseases; and here we meet with great difficulties in the measurement of each of the various factors of density, poverty, and dirt of the population. We might expect that one—namely, poverty—would regulate the other two, but it does not altogether do so, although it is one of the chief regulators.

### *Density of Population.*

Density of population seems to be the great promoting cause of Zymotic disease. This is shown by a comparison between the various London districts and between 13 large towns of the United Kingdom, as shown in diagrams II. and III. and tables II. and III. Of the 13 large towns—in 4 the density of population, as measured per acre, is above average; in 3 of these the death-rate is above average, and in these 3 the Zymotic death-rate is above average, the four being Birmingham, which is an exception to all such rules. Of the 28 London districts—in 20 the density of population is above average; in only 12 of these is the total death-rate above average, but in 17 out of the 20 (or 85 per cent.) the Zymotic death-rate is above average. This, I think, proves the connexion between density of population and Zymotic death-rate.

### *Pauperism.*

That pauperism has also a considerable influence in promoting Zymotic diseases, may also be shown from the London districts; for in 12 of the 28 in which the pauperism was

above average in 9 (or 75 per cent.) the Zymotic death-rate was above average—not so great as density of population, which gives 85 per cent. It is important here to show that the density of population and pauperism do not correspond; for in the 20 districts in which the density of population is above average, in only 8 is pauperism above average, and in 12 it is below. As might be expected, in these 8 both pauperism and density of population increased the Zymotic mortality. Therefore, though density of population is not the exact out-growth of pauperism, yet where both are combined the Zymotics prevail to the greatest extent.

### *Cleanliness.*

The next point is the effect of dirt in the promotion of Zymotic diseases; and that dirt has a large share in its propagation, I have no doubt.

We cannot as yet certainly ascribe any particular kind of disease to any particular kind of dirt. The characters which I have described as pertaining to fever streets and fever houses are pretty well known to sanitarians, and these are the resorts of all kinds of Zymotic diseases, where dirt is the most prominent character. Now, what is dirt in considering it in connexion with disease? It will not do merely to say that "dirt is matter out of place"—an excellent definition, nevertheless. I do not mean mere personal dirt, but dirty air, dirty food, dirty drink, dirty houses, dirty clothes, and dirty persons, all combined; and these kinds of dirt mean *poison* for human beings, and manure for Zymotic diseases to flourish upon. The refuse of cowsheds and stables is dirt in a farmyard, but it is food for the crops, and ends in being food for ourselves when, in nature's laboratory, it has been converted into bread and beef. Thus our domestic refuse is dirt when in and about our houses, or when it gets into our food or drink, or contaminates the air we breathe, but on the farm may be useful, for in the fields it is manure for the crops, but in the house is manure for the fertile growth of all Zymotic diseases.

I shall show you presently how dirt in air, water and food, may and probably does cause, certainly promotes, special kinds of disease. Cleanliness, as contradistinguished from dirt, means the removal of all useless or injurious matters from our persons, dwellings, food, and drink, the principal means adopted for which purposes are washings and scrubblings; and if we admit—which I think few will have the hardihood to deny—that some diseases are pro-



noted by contagion, it is manifest that in cleaning away dirt, we are removing the dirtiest though most minute of all dirt, the contagious particles of disease.

*Accommodation for the Sick.*

Another promoting cause of Zymotic disease is the want of proper accommodation for the sick, namely, proper and easily expansible hospital accommodation for all forms of contagious diseases, the want of proper means of bringing patients thither, the want of proper means of disinfection and separation of the sick and convalescents from contagious Zymotics from the healthy. I regret to say that all these wants exist to a lamentable extent in this city.

In pointing out what are principal promoting causes of all Zymotic diseases, I think I have shown pretty clearly how epidemic Zymotic diseases attack favourite haunts time after time, and that these same haunts are the favourite habitats for fever and diarrhœa at all times. The President of the College of Physicians in the next lecture will, I believe, show you conclusively some of the ways in which these conditions make those subject to them liable to disease.

I now proceed to point out the origin of some of the more important of these Zymotics, or, more properly, to show what conditions seem absolutely essential to the production of them. There are many Zymotics which never seem to arise without contagion, although they flourish best on the soil prepared for them in the ways already described. It is not because we cannot always trace contagion that we are to deny its existence, as I think will be clearly proved by Professor Haughton. As the subject of contagion will be fully treated of by that eloquent Professor, it is quite unnecessary for me to refer further to it, but merely state that evidence of the introduction of the most alarming epidemics of cholera and small-pox through contagion is overwhelming, and it is scarcely necessary to say that overcrowding and dirt promote contagion. I have now to consider certain conditions which have appeared so constantly in connexion with outbreaks of certain epidemics, that they seem to be essential to the production of these diseases, and may therefore be put down as causes of disease. The best established of these are the production of cholera, diarrhœa and enteric fever, in connexion with water contaminated with sewage matter, and air polluted with sewage gas; also the causation of typhus fever by overcrowding. Besides these,



we have it suggested, and substantial evidence given in support of the suggestions, that measles is produced by a miasma arising from decomposed vegetable matter, and that scarlatina is produced by decomposed blood and slaughter-house refuse.

But now, to consider these separately—

### 1st. Fevers.

Of these we have four kinds—simple, typhus, enteric, *i.e.* typhoid, and relapsing fever. The first appears to me to be a mere attempt at one of the other two next, namely, typhus and enteric fever, but not sufficiently developed to be able to identify it with either. This being my opinion, I believe it may arise under the same circumstances, and accordingly I find that it nearly always prevails where there is typhus or enteric fever, but especially where typhus prevails, as appears from the following table of 42 houses furnishing more than five cases each in two years:—

13 houses furnished cases of three kinds of fever.				
19	"	"	"	simple and typhus.
4	"	"	"	simple and enteric.
4	"	"	"	typhus and enteric.
2	"	"	"	simple only.
0	"	"	"	typhus only.
0	"	"	"	enteric only.

Nineteen houses furnishing typhus, furnished also simple fever. The condition which seems necessary to the production of typhus is overcrowding, and although overcrowding favours the spread of all kinds of contagion, yet in no disease has it been so frequently and closely associated with the first appearance of disease as in typhus. Dr. J. Heysham (1781) traced an outbreak in Carlisle to a house inhabited by 6 families, and where no windows that could be built up were left open, consequently there was no ventilation whatever. Typhus began here without any trace of contagion, and then spread through the rest of the town. In 1859, typhus fever, which for some months had disappeared from Edinburgh, arose in a poor locality where the houses were overcrowded, and in no instance was there any suspicion of contagion.

"Important evidence in favour of the view that the typhus fever poison may be generated from overcrowding, may be derived from the various records of what have been termed "Black Assizes," where Judges, juries, and others in court contracted fever from the exhalations from the prisoners, who, in the days prior to the time

of Howard, frequently suffered fearfully from what was termed 'gaol fever' in those days, but which was nothing more nor less than typhus produced by the overcrowding of gaols. The latest, therefore, most reliable account of a Black Assizes is that of 1750 at the Old Bailey, where 100 prisoners were tried. These were either placed at the bar or confined in two small rooms opening into the court. Many present were affected with a noisome smell. Within a week or 10 days, many of those present were seized with typhus. More than 40 persons died, including the Lord Mayor, two of the Judges, an Alderman, a Sub-Sheriff, and several of the jury. Neither the prisoners on trial nor any of those in gaol were affected by fever."—*Dr. Murchison.*

From this account it appears that the poison produced in those prisoners by overcrowding was exhaled by them, and affected those in their vicinity without any other apparent cause.

The following is a good example of the conditions under which typhus fever is produced, mentioned in Dr. Murchison's splendid work on fevers :—

"A court, 11 feet wide, with all matters as to drainage and water supply in good order, and recently constructed. Fever arose in house No. 10, which consisted of 2 floors connected by a narrow staircase.

Ground floors :    Cubic Feet.

Front room,	. 595	Occupied by a mother and 6 children and grandmother, who came to nurse those who were sick.
Back do.,	. 544	

Upper floors :

Front room,	. 680
Back do.,	. 497

"Before the arrival of the grandmother each had 163 cubic feet, after her arrival 142 cubic feet. Windows had all been shut up for the winter, and there was no means of ventilation. The rooms had the well-known animal odour of overcrowded houses."

This is only one sample of the conditions under which typhus is produced (street 36 A). I could mention a number of others from various authors, as also from the reports from the Dublin Sanitary Association and from my own experience. So many instances of this kind being recorded, and so many having been found to be the first beginnings of typhus epidemics, the conclusion is almost irresistible that overcrowding is sufficient to generate typhus *de novo*. An additional, though not absolute, proof that typhus fever is caused by overcrowding is that at the time of year at which overcrowding is greatest, namely, in the winter months,

typhus fever prevails to the greatest extent, as already pointed out by Dr. Moore, although, as I have shown elsewhere, during its prevalence it is temporarily increased by increased moisture and temperature.

### *Enteric Fever.*

The evidence that enteric fever is the direct product of food, drink, or air contaminated by the presence of decomposing sewage matter, or by the miasma exhaled thereby, is, if possible, stronger than the evidence of the production of typhus by overcrowding; because in the latter cases many other of the causes favouring the spread of Zymotic diseases co-exist, but in many cases, with regard to the former, nearly all other causes except the presence of the decomposing matter can be excluded. I need scarcely refer, in this assembly, to the sickness of the illustrious Vice-Patron of this Society, His Royal Highness the Prince of Wales, and his hospitable and noble friends, who were struck down with enteric fever at a time when almost, if not quite every cause was excluded except sewage exhalations.

I had recently experience of an epidemic of enteric fever breaking out in a large educational establishment in this city, owing to the want of proper drainage, which led to the contamination of the atmosphere with sewage exhalations and consequent sickness of a large number of those exposed to its influence.

The class-rooms in which the various students attended lectures were situated in one building. In this same building some of the male students resided. The remainder of the male students resided in a separate house in another street. The female students resided in a third building at a considerable distance from the building containing the lecture-rooms.

In the area of the building containing the lecture-rooms were situated latrines for the use of the male students only; there was also a pump in this area, but at some distance from the latrines, from which drinking water was occasionally obtained. This pump was partly supplied by well and partly by Vartry water, but there was no evidence that this pump supplied the usual drinking water for the male pupils. The situation of the latrines was so low (but slightly above high water mark) that the drainage of these was driven back at each rise of the tide, and when the tide rose very high the area itself was flooded with sewage matter of the most disgusting character. Thus all the gases from the decom-

posing sewage were mixed with the atmosphere breathed by the unfortunate pupils each time they visited the area. The result was that many of those who frequently visited this area (14 out of about 70), were attacked with fever, and of these 4 died. None of the female students and none of the others who frequented the lecture-rooms and who did not visit the latrines, were affected with fever.

As instances of localized outbreaks of fever depending upon sewage contamination of water, I may mention the instances of Terling, Guildford, and Winterton, mentioned in the reports of the Medical Officer of Privy Council.

Terling is a village in Essex, with a population of about 900 souls, is very much isolated and cut off from communication with neighbouring localities, so much so that most of the inhabitants are related to one another by marriage; their physical and moral characters are both very low. The inhabitants are nearly all farm labourers, living in houses constructed, with few exceptions, of lath-and-plaster, or worm-eaten wood. The people are all badly fed. The cottages are surrounded with almost every conceivable nuisance. "Slops and ashes," says Dr. Thorne, the Inspector who writes the Report, "thrown down in unpaved yards and gardens, manure heaps, cesspools, and masses of decaying vegetable matter"—all rubbish and excreta—lay scattered about in all directions.

"Surrounding one cottage and within a radius of 20 feet, I found one pig-stye, three manure heaps, two cesspools, and a privy the contents of which extended for 12 feet down an adjoining field."

In the centre part of the village, as shown in the map accompanying the Report, each cottage or each group of cottages has its own well, and if the ground is at all undulating this is sure to be situated at the lowest point. All are sunk in the gravelly stratum (which underlies the village) and as a rule uncovered, lined with loose bricks (without mortar or cement), depth 5 to 40 feet, according to height of ground. On a higher level and surrounding these wells, are all the nuisances mentioned above, the drainage from which, owing to the porous nature and lie of the ground, as a matter of necessity finds its way into the wells. None of the outlying houses have wells, but derive their water supply from pools in the fields frequented by cattle and described as "nothing better than stinking pools." Overcrowding was frequent, the sick sometimes being two or three in a bed; in some places 82 cubic feet of space was allowed to each person.

In this village 208 cases of fever of a very bad type



occurred besides diarrhoea, and 10 cases of fever in Terling-place, the neighbouring residence of Lord Rayleigh.

The first case of enteric fever arose in the person of Lord Rayleigh's dairy-maid, who drank the water taken from the river Lea in the immediate vicinity of the entrance of a sewer. This dairy-maid had been in Somersetshire but had returned three weeks before she got sick, and as the cases that followed next had no connexion with this case, the supposition of the introduction of the fever by this person is unlikely; it is more than probable she had also opportunities of using water from some of the village wells.

The epidemic followed the rising of the wells after their having been lowered by long-continued dry weather, the rising of the water being caused by wet weather, which, while it filled the wells with rainwater, also washed all the dirt in the vicinity into them.

The first cases which arose after that of the dairy-maid, were in five cottages built of wood, surrounded by pigsties and dirt, all dirt being thrown out into an unpaved yard sodden with dirt, in which yard is situated the well for all the inhabitants of the row.

At No. 1 there was 1 case and 0 death.

„	2	„	1	„	1	„
„	3	„	2	„	1	„
„	4	„	3	„	0	„
„	5	„	2	„	0	„

The well had dried up and not been used for two months, and water was obtained from a well in the neighbourhood where no great diminution of the water had taken place.

On November 19, a woman was ill, not of the fever, in one of these five houses, and water was wanted for cleansing purposes but none was in the well. On November 26, water was found to be in the well and was immediately used for drinking purposes. Ten days after using this water, or at the end of the time usually allowed for the incubative stage of enteric fever, the first case of fever arose in the person who had used the water, the other cases in these five houses immediately followed the first case.

The inhabitants of another set of houses in the immediate vicinity, who were deprived of their own water supply by the drought, got water from the same well as the first set of houses derived their supply from before the 26th of November. So long as they were thus supplied no fever appeared, but 14 days after the water returned to their own well, fever appeared amongst them in due course of time. The epidemic spread in the same way to the rest of the

village, and Lord Rayleigh's house became infected in a similar manner, those being affected only who used water from a well contaminated by sewage matter by leakage from a tank in the neighbourhood of the pump. From the peculiar construction of the house the portion of the inhabitants supplied with water from this source were completely isolated from those in the rest of the house.

Of course all the water in this village must have been contaminated with sewage matter for years. Why then did fever not arise before? The answer is simple; the wells were never before emptied by drought and quickly filled by wet weather, all the dirt being thereby concentrated in the first washing of the sewage-sodden earth.

An almost similar, though not so fatal, an epidemic arose at the village of Winterton. I may give an example of the commencement of this epidemic without further following its details.

A row of four houses were supplied with water from a pump well, within 14 feet of which were situated one open drain, one open ashpit, two pigsties, three privies, and one cesspool, all from 18 inches to 3 feet on a higher level than the well.

In No. 1 there lived 3 persons, 2 of whom had fever.

2	„	4	„	4	„	„	and 1 died.
3	„	7	„	7	„	„	
4	„	4	„	0	„	„	

The people in No. 4 would not drink the water because it had a bad taste, and therefore escaped the fever.

Guildford affords another example of how much influence dirty water has in producing enteric fever. This is a town which, in the year 1861, had a population of 9,000 inhabitants living in 1,675 houses. The town stands on chalk on the side of a hill. The stratum of chalk afforded a natural drainage for the town, all sewage being conducted into cesspools, which drained themselves into the chalk, and therefore remained nearly always dry, and were never known to be offensive. There was no system of drainage at Guildford at time of outbreak. The water supply was derived from several sources—

1st. From an old well sunk in chalk at the bottom of the hill, from which water is pumped by a water-mill.

2nd. A new well from which water was pumped to the upper parts of the town by engine power.

3rd. From private wells attached to the houses.

Nine hundred and twenty-eight houses are supplied from the first two sources, 747 from the private wells.

Some enteric fever always is present in Guildford in its poorer parts.

The outbreak occurred in the last days of August in the upper part of the town where it had not previously prevailed, and where the wealthier part of the population reside. What were the influences to which the infected districts became exposed, which were followed by the fever? There were in all 264 cases of fever, of these 177 were in the 330 houses supplied by the high service water supply, 30 in 598 houses on the low service water supply, and 57 in 747 which received no water from the public water works. This shows at once that those receiving the high level supply were more liable to enteric fever than any others; and excluding the ordinary cases, and the case of children who attended school in the infected districts, but who resided elsewhere, nearly all the fever arose among those drinking the high service water which was drawn from a reservoir in the high part of the town, kept filled from the well by the pumping engine on the low ground.

Up to August 1st these people had a constant supply of water from the high level reservoir; on that day the engine broke down, and the water supply from the old well and wheel was resumed. At this time there was still some water left in the high level reservoir, which was left there exposed to the influences of the heat of August weather, which would promote decomposition of any organic matter it might contain. On the 17th of August the water-wheel broke down, and thus the second supply to the occupiers of the high level district failed. Half a loaf being better than no bread, the small residue of dirty water was supplied to those houses, and then followed the fever. The well from which the water had been pumped was found to be contaminated with sewage, which was comparatively harmless until concentrated and acted upon by exposure to the summer heat while it lay undisturbed for nearly three weeks in the reservoir.

Two points are here illustrated:—1st, how sewage contamination poisons water; and 2nd, how this poison is increased in intensity by decomposition and concentration.

An outbreak of enteric fever at Islington has been shown by Dr. Ballard to have depended upon the sewage contamination of milk from a dairy-yard pump, which had been used to increase the value of the milk to the dairyman, at the expense of the health and lives of his customers.

Of 2,000 families resident within a quarter mile radius of the dairy-yard, 142 were supplied with milk from this dairy, of these 70 were invaded by enteric fever within 10 weeks.



"It is remarkable," says Dr. Ballard, "how typhoid picked out the customers of this dairy; thus in one long road and a street issuing from it, at a distance of a mile or more from the dairy, it supplied 3 families—of these, two had typhoid. It supplied 4 families in a neighbourhood of about 70 houses—of these, 3 had typhoid; it supplied 4 families in a row of 9 houses, typhoid occurred in 2 of them; and in the other 2, cases of a mild febrile character occurred."

And so on in many other instances. Dr. Ballard also shows that only those who consumed the milk were affected by fever, and of those who worked in the dairy-yard and did not use either the dirty milk or dirty water none had the fever. On examination, Dr. Ballard found that the pump from which the milk was, I believe, undoubtedly watered, was contaminated by sewage infiltration into the tank from which the pump water was derived.

Within the last few weeks similar examples have been presented by Dr. Russell, who showed that of 72 families in 5 streets supplied by a dairyman in whose family enteric fever prevailed, 22 had fever; and in 32 families supplied by this dairyman there arose 36 cases of fever.

In conclusion Dr. Russell remarks:

"I regard this as an extreme illustration of what most frequently happens where the sale of articles of food is conducted in close connexion with families, and all their attendant ailments. Milk is, from its composition, a peculiarly favourable medium for the propagation of the germs of disease, and particularly of enteric fever, and it is very likely that many apparently inexplicable outbreaks of enteric fever in families are caused by milk, or even solid food contaminated in the retail shops, especially among the poor. It is a very common practice in all parts of the city for parties to live and rear families in rooms behind shops, through which often the sole access lies, and in which groceries, milk, provisions of all kinds, sweetmeats, fruit, &c., are sold. These shops are 'served' by one or both parents, or by some grown-up child, and when infectious disease enters such a family, it cannot fail to be the source of quite peculiar risk to the public. I have been so much impressed with this by a series of cases in point, that I applied to Mr. Lang, the Procurator Fiscal, to ascertain what legal powers existed to deal with them. Mr. Lang writes his opinion that persons situated as described in the various instances given in your letter have not proper lodging or accommodation. It will, therefore, be possible by this and other provisions of the Public Health Act to deal with such cases, so as to save the poorer classes from the obvious dangers of contagious sickness in such circumstances. I have, therefore, issued to the Sanitary Inspectors an instruction that systematic attention be paid to the health of all families living in the circumstances described, by a more routine visitation than from the

character of the people and the locality might be thought necessary. Any case of infectious disease discovered must be specially and immediately reported to the medical officer. The greatest care is to be taken not to injure the interests of the parties referred to by unnecessary publicity in the discharge of this duty ; but at the same time there is a very obvious danger to the public from their private sickness, arising from their mode of living, which quite warrants the interference of the department.'

"The fatal activity of milk as a cause of disease has also been most carefully and scientifically investigated by Dr. Taylor, of Penrith ; Dr. Bell, and Dr. Thorne. It has been shown that not only typhoid but small-pox, scarlatina, and even cholera, have probably been communicated to people through the medium of milk. It is, therefore, of the utmost public importance to inquire into the sanitary condition of the cow-sheds and dairy-yards.

"The following is a graphic description of the dairy-yards in the south side of the city, by Mr. Benson Baker, of London, who published some notes on a sanitary tour through Dublin about two years ago. Any one who will take the trouble to investigate the matter now will find it equally applicable :—' In the most densely-populated and fever-infected district, in close vicinity to the Corporation manure depot in Marrowbone-lane, are to be found the cow-sheds and dairy-yards of Dublin. These yards, like the neighbourhood, are abominably filthy ; manure is allowed to accumulate in heaps, from which may be seen small black fetid streams flowing into the open streets. The effluvium from these yards is absolutely poisonous, and is only equalled by the atmosphere in the cow-sheds. In this district man and beast alike fall easy victims to preventable disease.' Speaking of the condition of the cows, he adds—' Dr. Cameron says that the loss from pleuro-pneumonia sustained by Dublin dairymen is at least 10 per cent., yet the dairymen cannot be convinced that the disease is contagious, and, therefore, unless under compulsion from the sanitary authorities, they never disinfect their premises after the removal of diseased beasts from them.' The vital powers of the cows are lowered by their constant respiration in close fetid stables. In some of the sheds the cubic space allowed for a large cow is less than the minimum—viz., 300 cubic feet of breathing room—allowed a man in a registered lodging-house. The cows were so close to each other that it was impossible that they could all lie down together. On questioning the owner on this point he facetiously replied, 'Gorra, sir, they take it turn about.' This repartee might excite a laugh if the occasion of it did not inflict cruelty on the beasts, and tend to affect the people with disease. It is not surprising to learn that milk obtained from cows herded together in such unsanitary conditions, not only conveys foot and mouth disease, but typhoid and other zymotic diseases to the consumer."

I have little doubt that many cases of fever and diarrhoea



are produced in a similar way in Dublin, by the sewage contamination of milk. Any one who visits a Dublin dairy-yard, must have been convinced that the milk derived therefrom must run great chances of sewage contamination of some sort, for more fearfully filthy places can scarcely be imagined. Where causes of enteric fever and typhus co-exist, both diseases will arise at same time and sometimes even in same person, as I have shown to be the case in an account of fever at 50 Bishop-street.—*Irish Hospital Gazette*.

While on this subject I may mention that not only enteric fever, but cholera, small-pox, and scarlatina, are liable to spread in this way. I have treated dairy-maids for small-pox and scarlatina, and I regret to find on Dr. Mapother's street list of cholera in Dublin, in 1866, which he has kindly lent me for the purpose of this lecture, that many dairies are included as having been invaded by this disease. Dr. Taylor has demonstrated how scarlatina was spread in Penrith by means of milk, and similar observations have been made by Drs. Bell and Thorne. I believe I narrowly escaped a visitation of cholera in my own house from a similar cause in 1866. It is to be hoped that if, notwithstanding Dr. Cameron's efforts, our dairymen still persist in diluting our milk they will confine themselves to Vartry water. Dr. Reynolds has shown you how to distinguish in many ways good milk from bad, but unfortunately no means is as yet known for distinguishing milk poisoned by disease germs. The same conditions which favour the spread of enteric fever, also favour the spread of diarrhoea, and in point of fact many deaths of enteric fever, especially in children, are registered as cases of diarrhoea. Enteric fever is a disease of summer, when the decomposition of sewage matter is favoured by the high temperature. Additional proof of the constant influence of poisoning by sewage matter is drawn from the Reports of the Medical Officer of the Local Government Board (formerly of the Privy Council) of England, where in every instance where a town is reported as infected by enteric fever, we find that the arrangements were such that the inhabitants were poisoned by their own sewage.

Relapsing fever is generally believed to be the direct product of famine, but being contagious may communicate itself to well-fed persons. It is as Dr. Stokes informed you, when speaking of the great famine fever, frequently followed by typhus.

*Cholera.*

In close relation to enteric fever as to causation, stands cholera. The most constant condition connected with the spread of cholera is an impure water supply, or a supply contaminated with sewage matter. I could give numerous instances of this, but shall confine myself to the one of London, where terrible experiments have been carried out on a most gigantic scale, which prove the relation between impure water supply and cholera. I do not mean to say, positively, dirty water produces cholera, but it certainly promotes it, whether by containing the germs of that dire disease, or by merely affording a suitable and apparently necessary soil for the disease to grow upon.

This I may say has been demonstrated by the various effects produced in London by the different cholera epidemics of 1854, 1849, and 1866, on each district according to the nature of the drinking water supplied to the inhabitants. This was first pointed out by Mr. Simon, in his "Report on the cholera epidemics of London, as affected by the consumption of impure water," published in 1856. This Report was the result of most painstaking and lengthy inquiry into the most minute details of water supply, population, and distribution of cholera in 1849 and 1854, in the London districts lying south of the Thames. A similar report by Mr. Radcliffe has been published in the Report of the Medical Officer of Privy Council for 1866, showing the connexion between the diffusion of cholera and impure water supply in the east end of London, in the last cholera epidemic, that of 1866.

In the epidemics of 1849 and 1854, cholera fell with the greatest severity on the portion of London lying south of the river, under the following circumstances:—

There were, and I believe are still, two companies supplying this district (which comprises St. Saviour's, St. Olave's, and St. George's, Southwark, Bermondsey, Newington, Lambeth, Wandsworth, Camberwell, and Rotherhithe) with water, the competition was great between these two companies, so great that out of 31 sub-districts there were but eight which had but one company's mains within it, and in many cases the mains of both companies run parallel in the same streets, supplying about equal number of the houses. Thus the population supplied by the two companies were so intimately mixed, that with the exception of the water supply the conditions were identical. We have thus a most



perfect arrangement for testing the influence of bad water in promoting cholera. The two companies in question were the Lambeth Company and the Southwark and Vauxhall Company, supplying a population of about 466,000 in 1849, and about 511,000 in 1854.

In 1853 and '54, the Lambeth Company, which derived its supply from the Thames at Ditton, a source pure (dirty though it may be) in comparison with that of the sister company, supplied 24,854 houses, comprising a population of 166,906 persons, and there occurred 611 cholera deaths, being at the rate of 37 to 10,000 persons living.

The Southwark and Vauxhall Company derived their supply from the Thames at Battersea, which was "found to be of almost incredible foulness," swarming with living things and filled with particles of dirt. In 39,726 houses, comprising 268,171 persons, there occurred 3,476 cholera deaths, or at the rate of 130 to every 10,000 of those living, or about three and a half times as many as those drinking the better water.

In 1854 the Lambeth Company gave the best water, but in 1849 it gave worse than the Vauxhall Company, for the Lambeth Company during the interval moved their works up the river, while the Vauxhall Company remained where they were, and even this source became more impure from the increased drainage poured into the Thames by the increased population of London. Accordingly we find that in the epidemic of 1849, in the houses of the Lambeth Water Company's tenantry, there died no less than 1,925 persons although the population was less than in 1854 when but 611 died of cholera.

In 1849 there died among the Vauxhall Company's tenantry 2,880, or less than the 3,476 of 1854; making all allowances for increased population, the mortality was higher than 1849, and the water worse. It is thus clear that, in the southern districts of London where the water supply improved, cholera was less, and where it became worse cholera was more prevalent. In 1866, when, by the enforcement of a new Act of Parliament, the Vauxhall Company had been compelled to obtain a new supply, and the Lambeth Company had improved its supply, there was but little cholera on the south side of the Thames. On the other hand, a dirty water supply poisoned the greater portion of the east end of London on the north side of the Thames, as shown in Mr. Radcliffe's report, previously referred to.

The East London Water Company supplied two districts, both of these were infected by cholera, one severely, the other

but slightly. There were two sets of reservoirs—one at a place called Lea Bridge, the other Old Ford. The district supplied from Lea Bridge was severely affected; that supplied from Old Ford was terribly swept by the epidemic. But why was this when the water was from the same sources in both cases, and why did not cholera always pervade the population supplied from the Old Ford reservoir? The “Old Ford” reservoir was contaminated by sewage from the River Lea, which at that point was a sort of canal, into which drains emptied themselves, and which were possibly even contaminated by the drainage from the first cholera cases. It was not until in consequence of a short supply of water that this reservoir was used that cholera spread through the district. A map accompanying the report shows, by shadings, the various degrees in which cholera invaded the different districts of London in 1866, and graphically demonstrates how fatally the district supplied by the Old Ford reservoirs of the East London Water Company were affected.

The story of the Broad-street Pump by Dr. Snow further proves the influence of dirty water in spreading cholera, as also did a special outbreak in connexion with a pump in Duke-street, in this city. Thanks to the exertions of my friend and fellow-citizen, Sir John Gray, we are not likely ever to suffer from the effects of an impure water supply; and I have no doubt that when cholera again visits us we shall have few such stories as that of the “Duke-street Pump.” But we must not here forget Dr. Reynolds’ remarks about the poisoning of water by dirty cisterns.

Valuable evidence in support of the connexion between cholera and water supply is given in Dr. Pettenkofer’s papers on the connexion between cholera and ground water; as also the instructing paper by Dr. Mapother on the relation between old rivers and sewers, and the distribution of cholera in Dublin, in which he showed the predilection of cholera for these sites.

### *Measles.*

Next, we have to see under what circumstances measles arise. The only conditions yet shown to be intimately connected with measles are decomposition of vegetable matter, especially straw, and the presence of the lowest forms of fungi, commonly called mustiness.

Dr. Salisbury, of Newark, Ohio, United States, has demonstrated, beyond doubt, his ability to produce measles (or a



disease undistinguishable from it), just as the gardener can produce mushrooms by preparing a bed upon which they are to grow.

Dr. Salisbury refers to the various fungi which attack grain as smut and bunt, to those attacking animals as Mursadine (*Botrytis Bassiana*) attacking the silkworm, and the mould which kills the house fly in autumn (*Sporendonema muscæ*), and which we see as white rings around the poor little animal's body, and finally against our window panes after the death of the fly. Many skin diseases are now known to be associated with the production of vegetable growths on the surface of our bodies.

1st. Dr. Salisbury points to the case of Mr. Dill, who got an attack undistinguishable from measles while engaged in turning over a stack of musty straw, the odour from which persistently remained in his nostrils for long after he had done handling the straw.

2nd. In an outbreak of measles at the military camp near Newark, Ohio, there was no trace of contagion; the outbreak followed immediately on the melting of the snow while wet, which made musty the warm straw which the men slept upon in their tents.

3rd. Cases mentioned by Mr. S——, in the persons of those employed in thrashing wheat that had become heated.

These cases suggested to Dr. Salisbury the inquiry, whether camp measles were caused by musty straw. He examined the musty straw (wheat straw) to which had been attributed the cause of the measles, he found certain fungi which are figured in his work. He, to prove their identity with wheat straw fungi, grew them in a box.

He then grew some fungi with which he inoculated himself, and produced the symptoms of measles with a partially developed rash; a second inoculation failed to produce similar effects. Similar effects were produced by inoculation of his wife.

In a family where measles broke out, inoculation by the straw fungi, while giving measles of a modified form, prevented the occurrence of unmodified measles. These are substantiated by other evidence, and are still further proved by the observations of Dr. Moore, which proved that measles is a disease of warm weather, or in other words, of that kind of weather which promotes the growth of the lowest forms of fungi and mouldiness.

Measles have been also shown to arise in connexion with musty linseed meal, by my friend and former colleague at

Cork-street Hospital, Dr. Henry Kennedy, in a paper in the Dublin Medical Journal.

The only miasm which has as yet been shown to have any special connexion with scarlatina is that arising from the decomposition of slaughter-house refuse. This origin for scarlatina was first suggested by Dr. Carpenter of Croydon. Scarlatina has also been attributed to overcrowding; but I have not yet been able to convince myself that the prevalence of scarlatina in connexion with overcrowding is to be attributed to any other effect of overcrowding than the well known tendency of that condition to favour the spread of contagion. To consider the question of the influence of slaughter-house refuse—Dr. Carpenter has shown in 9 cases of localised epidemics of scarlatina where the possibility of contagion seemed to be excluded, that the presence of decomposing slaughter-house refuse was the only assignable cause. It is unnecessary to give the details of these cases, but the most of them occurred under circumstances where all other sanitary arrangements were good.

The origin of scarlatina in connexion with decomposing slaughter-house refuse, is further confirmed by an analysis of the death registry of No. 2 district of the south city district, undertaken by Dr. Maunsell, who found that out of 6,000 deaths registered in that district during the nine years 1864 to '72 inclusive, there were 268 deaths from scarlatina, of these 95, or more than one-third, occurred in the immediate neighbourhood of the slaughter-houses connected with the Clarendon, Castle, and Blackhall Markets, and another limited neighbourhood containing but one slaughter-house. The area in which these deaths took place is but one-eighth of the whole district. Two of these slaughtering districts are not remarkable for the prevalence of Zymotic disease.

The conditions which are essential to the production of whooping-cough are at present unknown, but the constancy with which it follows measles, points to the fact that what will control the latter will also control the former. Dr. Moore has shown how whooping-cough prevails in winter, measles in summer—the former following the latter and being aggravated by the effects of low temperature, favouring chest affections generally. No condition is yet known essential to the production of small-pox, but this is the most preventable of all Zymotic diseases by the simple and certain method of vaccination, so certain and safe a measure, that everyone is convinced of its certainty and safety except a few misguided and wrong-headed people who are more to be pitied than



feared, and who should for the safety of society be handed over to the Commissioners who take care of the welfare of persons of weak intellect.

If other instances were required to show the value of sanitary measures, they could easily be produced. I will only mention two others as being derived from our own city. The cases of *trismus nascentium*, or nine days' fits, arising in infants in the Lying-in Hospital which have been I might say, annihilated by the preventive measures of ventilation and cleanliness first instituted by Dr. Clarke, and thus described in Dr. Churchill's able work on diseases of children :—

“No institution as far as I know has ever afforded such ample experience of the disease as the Dublin Lying-in Hospital, before the improvements in ventilation and cleanliness introduced by the late Dr. Joseph Clarke, to whom we are indebted for the best description of the attack. Dr. Joseph Clarke enumerates three especial existing causes of the disease—first, impure air ; second, neglect of keeping the infants clean and dry ; and third, irregularity of living on the part of the mothers, especially the abuse of spirituous liquors. At the end of the year 1782, of 17,650 infants born in the Rotunda Hospital 2,944 died within the first fortnight, or nearly every sixth child, and that owing to trismus. After the precaution he (Dr. Clarke) adopted the same pure and adequate ventilation in the hospital, out of 8,033 born alive, only 419 died in the hospital, or only 1 in 19½. During Dr. Collins' Mastership, of 16,654 infants born there were only 37 cases of trismus. Here is a splendid instance of the results of preventive medicine.”

The other is the case of puerperal fever, a disease originating in the overcrowding of parturient women, as referred to in Dr. Farre's letter, quoted in the commencement of this lecture, which I think is very well shown in Dr. Evory Kennedy's work on this subject and the truth of which I believe has been fatally demonstrated in the Dublin Lying-in Hospital, but which, thanks to the reforms introduced by the late Dr. Collins, to the energetic efforts of the present Master, Dr. Johnston, and to the knowledge of defects pointed out by Dr. Evory Kennedy, is not likely again to afford the opportunity for demonstrating the dependence of this disease on bad sanitary arrangements.

Puerperal fever can, I believe, be almost if not altogether annihilated, like the nine days' fits, by isolation of the mothers either by separate buildings, as suggested by Dr. Kennedy,

or by the complete isolation of the various wards by some other means.

Having shown the chief, original, and promoting causes of zymotic disease, it is manifest that the remedies are—

1. In building new towns or villages to select healthy sites.  
2. Proper drainage, both house drainage and general drainage.

3. To prevent old ruinous and dirty houses from being inhabited, and to prevent new houses from being constructed so as to be injurious to the health of their inhabitants. Mr. Henderson will point out in his lecture how this is to be effected.

4. To prevent overcrowding either in houses or districts. This must be accomplished by constant inspection of all houses inhabited by the poor, by the regulation of the width of streets, the promotion of open spaces within towns, and by the breaking up of closed courts, and the making of wide thoroughfares through closed up neighbourhoods.

6. To promote cleanliness—1st, By the employment of all legal powers to compel and assist in the removal of dirt; and 2nd, To educate the people to believe that “cleanliness is next to godliness.”

7. To provide proper accommodation for the sick at all times, and also during epidemics:—(a.) By proper hospital accommodation at all times. (b.) By proper means of bringing patients to hospital. (c.) By the provision of special hospitals or wards, in connexion with general hospitals, to be used only in time of epidemics. (d.) Refuges where the healthy can be separated from the sick until the sick can be removed to hospital, and the houses or rooms they occupied cleansed and disinfected. (e.) The provision of accommodation for convalescents from zymotic diseases in convalescent homes. (f.) Proper and systematic disinfection of all places where sickness prevails or has prevailed.

These must be all accomplished by means of a well organised sanitary system, and I am sorry to say such a system exists in but few large towns, not at all, I may say, in the country, and scarcely anything worthy of the name of organization is at present to be found in Dublin. The treatment of the sick and the prevention of disease should be under the same department, which should also have under its control all matters for the relief of the poor, registration of births and deaths, and the performance of vaccination. Each large district should be under a Chief Medical Health Officer and every dispensary district should



have for its Sanitary Officer the dispensary Medical Officer acting under the Chief Officer of the district. The Chief Officer should have almost absolute power, and should be only appointed with the consent of, and also removed by the chief sanitary authority of the state, namely, the Local Government Board. The absurdity of placing the administration of sanitary matters under the *absolute* control of Committees of Town Councils and Poor Law Guardians, many of them frequent offenders against sanitary law, is so great, that it will be at once perceived by every intelligent and thoughtful person.

I wish now to return my thanks to those who have given me their assistance in collecting materials for this lecture, namely, to Mr. Simon, the Medical Officer of the Privy Council; Dr. Burke, Medical Superintendent of the Irish General Registration Office; Dr. Ballard, of the English Local Government Board; Dr. Mapother, Medical Officer of Health for this city, and Dr. Maunsell, the able and energetic Secretary of the Poor Law Medical Officers Association. I have endeavoured to fulfil my difficult task to the best of my ability, and I trust that any shortcomings may be excused, and that you will believe that I have done my best to make a grave medical subject as little unpleasant and as interesting and useful as possible.





